Independent
Advisory Panel
on Deaths
in Custody

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Prison overcrowding and deaths in England and Wales: findings from a predictive analysis and modelling study

2025

Chair's Foreword

Keeping those in the care and custody of the state safe is a fundamental duty of any government. The ongoing crisis in prison capacity and overcrowding has made meeting this critical duty especially challenging.

Our most recent statistical analysis of deaths in custody found that mortality rates for individuals in prison continue to be significantly higher than those for the general population. But there remains a real gap in our understanding of how deaths in custody may be impacted by prison population levels and overcrowding.

This report aims to address this gap, seeking to explore how increases in the prison population and occupancy pressures may affect future mortality trends across different causes of death, including natural and self-inflicted deaths. Drawing on a ten-year analysis (2014–2024) of prison mortality and overcrowding in England and Wales using robust methods, it models the projected total annual deaths for the period 2025–2029, highlighting the risks posed by sustained overcrowding and the growing prison population.

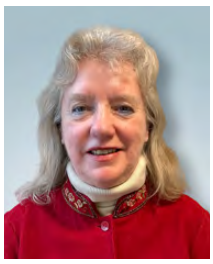
The findings presented in this report are both timely and troubling. Although the prison population has fluctuated over the past decade, projections from the Ministry of Justice indicate a sustained increase – from approximately 88,000 in 2025 to 100,800 by 2029. As the prison population in England and Wales continues to grow, so too does the risk of death to those in custody.

The report's projections are stark: while the prison population is expected to grow by 13% between 2025 and 2029, self-inflicted deaths are expected to rise by 21%, a disproportionately higher increase. The empirical modelling suggests that prisons operating above capacity experience significantly higher rates of self-inflicted and natural deaths, particularly in Category B prisons. Multiple factors may explain these concerning connections, with overcrowded prisons less able to deal with self-harm and suicidality and also not fully meeting increasing healthcare and staffing pressures.

In light of this, our report outlines the importance of targeted suicide and self-harm prevention in prisons with occupancy rates at or above 100%. This report also calls for a coordinated response to an increased custodial population and overcrowding that includes investment in prison infrastructure, enhanced data sharing to support independent research, and a need for targeted interventions, including improving and adequately funding expanded mental health services, improved healthcare provision, and more robust suicide prevention strategies.

These findings also reinforce the urgency of implementing the recommendations of the Independent Sentencing Review, published in May of this year, which was established to address the unsustainable growth of the prison population. The Review advocates for a shift toward more effective, community-based alternatives to custody and a reduction in unnecessary imprisonment – measures that would directly alleviate overcrowding. If our report is correct, such measures may well save lives.

Finally, I would like to give special thanks to Denis Yukhnenko, postdoctoral researcher at the University of Oxford, working under the guidance of IAPDC member Professor Seena Fazel, for their expert advice and the diligence with which they carried out this comprehensive report.



Lynn Emslie

Chair of the Independent Advisory Panel on Deaths in Custody

Executive summary

This report presents findings from an analysis of prison mortality and overcrowding in England and Wales over a ten-year period (2014–2024). Using nationally representative prison-level data and official government projections, the present study examines how increases in the prison population and occupancy pressures may affect future mortality trends overall, separated by the main causes of death (natural, self-inflicted, and other deaths). Projections for total annual deaths in prison are presented for the period 2025–2029.

Background

Recent projections from the Ministry of Justice (MoJ) indicate that the prison population will increase by over 12,000 individuals by 2029, reaching approximately 100,800. Many prison facilities are already operating above their intended capacity, raising concerns about the impact of sustained overcrowding on prisoner health and safety. This analysis addresses a critical gap in understanding the broader health implications of these pressures-specifically in terms of mortality risk.

Key findings

- Overcrowding is systematically associated with increased mortality across most prison categories, especially for self-inflicted and natural deaths. These associations vary by prison type and cause of death.
- Establishment-level variation. Mortality patterns differ substantially across prison categories, with self-inflicted deaths strongly linked to overcrowding in closed male facilities (Categories B and C).
- High-risk settings. Category B prisons, despite housing fewer individuals than Category C prisons, are projected to experience disproportionately high numbers of deaths, particularly self-inflicted deaths, highlighting the need for targeted healthcare and suicide prevention interventions in these settings.
- Projected increases in deaths. If current trends continue, total annual deaths in custody are projected to rise from 319 in 2025 to 359 by 2029. Self-inflicted deaths are expected to increase by 21% (a disproportionately higher increase), and natural (referring to mortality from internal causes, such as cancer or chronic physical conditions) deaths by 12%. Most of these deaths are expected to occur in Category B and C prisons.
- Increases in preventable deaths. By 2029, a conservative estimate suggests that 145 deaths in custody, approximately 40% of the total, will result from external causes, including suicide, overdoses, and other potentially preventable events.

Implications

The findings suggest that continued growth in the prison population (without corresponding investment in capacity, staffing, and healthcare) will likely exacerbate mortality risks, particularly in already overcrowded facilities. Targeted investment in mental and physical healthcare services, improved infrastructure, and population management strategies might be needed to reduce the projected rise in preventable deaths.

Future directions for research

While the study identifies consistent associations between overcrowding and mortality, it does not directly examine the causal pathways through which these effects occur. Self-harm and violence may represent important intermediary mechanisms linking overcrowding to mortality, but their contribution requires further investigation. Future research should draw on establishment-level data to explore causal pathways linking overcrowding, mental health, violence, self-harm, and mortality. The MoJ should enable and consider funding high-quality independent research through enhanced data-sharing and collaboration.

Recommendations for practice

- Expand healthcare provision, particularly mental health services, in high-risk environments such as Category B male prisons.
- Target suicide and self-harm prevention in prisons with occupancy rates at or above 100%.
- Enable establishment-level research by allowing routine data sharing with independent research teams to better understand mortality risks and how to mitigate them.

Contents

Introduction

Deaths in custody continue to be a major public health and criminal justice issue in England and Wales. Prior research suggests that mortality rates for individuals in prison are higher than those for the general population, indicating greater vulnerability within the incarcerated population (Botchway & Fazel, 2022; Independent Advisory Panel on Deaths in Custody, 2024). At the same time, the average size of the prison population continues to grow. Although the prison population in England and Wales has experienced substantial fluctuations in both directions over the past decade, recent projections suggest a significant increase from approximately 88,000 in 2025 to 100,800 by 2029 (MoJ, 2024a). This projected growth and the associated increases in overcrowding rates raise important questions about the potential impacts on prisoner health outcomes, particularly mortality rates, which have already exhibited concerning trends in recent years.

Mortality rates in prisons in England and Wales are reported regularly by the MoJ across several outcome categories. These include deaths from any cause – self-inflicted deaths, deaths from natural causes, and homicide – as well as deaths from other causes, including unintentional drug overdoses (MoJ, 2025). While increases in the prison population will likely raise the absolute number of deaths in each category, the relationship may be more complex. As prison populations exceed establishment capacity, this increase may have disproportionate effects on certain types of deaths, many of which may be preventable.

This report presents an analytical overview of deaths in custody by cause. It also aims to model the relationship between prison population and overcrowding (the placement of prisoners beyond capacity) on the one hand, and deaths in custody on the other, with the goal of predicting potential excess mortality associated with projected increases in the prison population.

This report aims to answer the following research questions:

1. What are the associations between the prison population, prison overcrowding, and deaths in custody?
2. How do these associations vary by cause of death?
3. How do these associations vary by prison category?
4. What is the predicted change in deaths- including potentially avoidable deaths - given anticipated changes in the prison population?

Methods

Data sources and observation period

This study relies on publicly available data sources published by the United Kingdom's MoJ Statistics Office and the Office for National Statistics. Key sources include MoJ statistical releases on deaths in custody and prison population data (MoJ, 2024b, 2025), *Safety in Custody* reports on self-harm and assaults (MoJ, 2023), and *Monthly Prison Population* figures, which provide up-to-date information on capacity and population levels in England and Wales (MoJ, 2024b). Data from Scotland or Northern Ireland are not included. The data coverage period varies for different metrics; however, the main observational periods are from January 2002 to September 2024 for trend data, and from October 2014 until September 2024 for mortality data.

To conduct the main analysis, data on prison occupancy and mortality were aggregated. The primary dataset includes information on all prisons in England and Wales operating over the 10-year period from October 2014 to September 2024 (N = 127), incorporating variables such as prison security category, gender distribution, operational capacity, population, and occupancy rates. Male prison security categories range from Category A (high-security facilities for prisoners who pose the greatest threat to the public) to Category D (open prisons with minimal security), with additional categories for Young Offender Institutions (YOIs), which house offenders aged 18–21. For the purposes of analysis, where a prison is assigned multiple security categories, the highest category is used for final classification. The female estate was analysed separately, distinguishing between female closed prisons (with higher security levels) and female open prisons (with minimal security restrictions).

Measures

The prison population was examined at two levels: total and establishment-level. First, the total prison population in England and Wales, measured monthly during the observation period, was analysed by age distribution and sex to estimate potential demographic shifts. This temporal analysis identified broad trends in prison occupancy from 2000 to 2024. Second, for establishment-level analyses, the average population over the 10-year period from 2014 to 2024 was calculated for each of the 127 individual prisons. These prison-specific averages were used as the primary population metric in the regression models, with prison security categories and gender composition included as key covariates.

As a measure of prison capacity, the overcrowding rate based on Certified Normal Accommodation (CNA) was used. CNA represents the intended capacity of a prison under standard conditions-that is, the number of prisoners who can be accommodated in decent and safe conditions (HM Prison & Probation Service, 2023). The CNA-based overcrowding rate is calculated as the ratio of the actual prison population to the CNA capacity, expressed as a percentage. Values exceeding 100% (or over 1, if expressed as a proportion) is interpreted as indicative of overcrowding.

Another potential measure of prison capacity, operational capacity, is defined as 'the total number of prisoners that a prison can hold, taking into account control, security, and the proper operation of the planned regime' (HM Prison & Probation Service, 2023). Operational capacity is typically higher than CNA and is considered a more practical measure of the maximum safe capacity under current conditions. However, no association is observed between operational capacity and the outcomes of interest, and this measure has therefore not been included in the further analysis.

Statistical analyses

Trends in the prison population and mortality rates over time were examined to identify temporal patterns and potential associations. These trends were analysed by demographic factors (age distribution and gender composition) to detect differential impacts across subpopulations.

The comparison between crude and age-standardised mortality rates is used to estimate mortality independently of changes in the age structure of the prison population over time, providing a more accurate basis for comparing trends across years. This adjustment is especially important in custodial settings, where an ageing population can inflate crude death rates and obscure underlying patterns unrelated to changes in healthcare provision or prison conditions.

To investigate the relationship between prison characteristics and mortality outcomes, both prison population size and overcrowding levels were examined graphically. Scatter plots were generated to illustrate the associations between average population and average deaths, as well as between average occupancy and death rates. Log-linear trend lines were fitted to the data and weighted by prison population size to reflect relative institutional scale.

An exploratory k-means cluster analysis (with k = 3, 4, and 5) was also conducted to identify general groupings of prisons based on occupancy trajectories. This approach allows similar items or cases to be grouped based on patterns in the data, within a specified number of clusters (k). The resulting clusters of prisons are found to overlap substantially with formal security categorisations. Given the interpretability and policy relevance of official classifications, subsequent analyses were conducted using the formal prison categories as covariates.

Predictive modelling

Building on the initial findings from the statistical analysis, predictive models were developed to formally test the associations identified during the exploratory phase and to enable projections of future mortality under different population scenarios. Regularised negative binomial regression was employed to model the relationship between prison characteristics, overcrowding, and mortality outcomes.

This approach is widely used in medical statistics to investigate associations between outcomes and explanatory variables (e.g., between mortality and overcrowding), allowing the effects of individual factors to be assessed independently. Negative binomial regression is particularly suited to analysing count data, such as the number of deaths, and is especially useful when the frequency of events varies substantially across groups or settings (Hilbe, 2011).

The predictive models were trained on data averaged across the observation period from 2014 to 2024, including prison population, capacity, overcrowding estimates, and the number of deaths from different causes. Observations were weighted by time using a linear weighting scheme, such that more recent observations contributed more to the final model than older ones. In addition, the average effect of the COVID-19 pandemic on total mortality in prison was estimated separately to adjust the weighting of observations during the pandemic period appropriately. For the rationale and details of this adjustment, see Supplement 1.

Choosing the predictors in the model

Building a predictive model requires an initial set of features, also known as predictors or covariates, that may be associated with the outcome of interest. These associations can be directly causal or indirectly informative, for example, arising from a shared underlying process or statistical correlation. Feature selection is then applied to identify the most useful predictors- those with the highest predictive validity. Each selected predictor is assigned a weight (coefficient) that reflects its contribution to the overall prediction.

The model itself is constructed as a function, chosen based on the properties of the data, modelling objectives, and practical considerations. This function aggregates the predictor values, weighted by their coefficients, to estimate the outcome of interest- such as the number of deaths from a specific cause.

The first group of predictors included in the model comprised the average prison population over the observation period and the prison security category. Prison categories were encoded using binary variables as follows: Category A, B, C, Young Offender Institution (YOI), Female (Closed), and Female (Open). The categorisation of prisons was not exclusive, meaning that a single prison could belong to multiple categories if it operated multiple corresponding sites. In general, if two sites within one prison were grouped together in the monthly prison population statistics published by the MoJ (2024b), they were treated as a single prison belonging to multiple categories. If they were reported separately, they were treated as distinct entities.

Each prison was assigned a category based on its classification at the time of the most recent available observation. However, for clarity in reporting, in the present study, prisons assigned to multiple categories in the training dataset were presented either according to their highest security category (e.g., if a prison included both Category B and C sites, it was treated as Category B) or as part of a predefined combination (e.g., Category B + YOI).

The second group of predictors comprised indicators of overcrowding, constructed to capture potential non-linear effects. The average occupancy percentage was grouped into five levels: well below capacity (< 90%), close to capacity (≥ 90% and ≤ 100%), light overcrowding (> 100% and ≤ 110%), moderate overcrowding (> 110% and ≤ 120%), and high overcrowding (> 120%). These levels were coded as binary indicator variables and included in the model as covariates.

In total, the initial set of features comprised 23 candidate predictors: average prison population; fourteen binary covariates representing prison type, gender, and overcrowding levels; and eight interaction terms between average occupancy proportion and selected prison type and gender variables. These interactions were included to capture potential variation in the effects of overcrowding across different prison settings.

Model specification and predictor selection

Separate models were initially constructed for five mortality outcomes: total deaths, self-inflicted deaths, homicides, natural deaths, and other deaths. For each outcome, feature selection was performed, and a separate model was developed. Due to the rarity of homicides, they were later combined with other deaths into a single category. The model specification is provided in Supplement 2.

To improve model stability and prevent overfitting in the presence of multiple correlated predictors, elastic net regularisation was applied. Overfitting (i.e., poor generalisability) occurs when a model captures random noise or patterns specific to the training data, rather than underlying relationships that generalise to other samples. Regularisation methods help prevent this by constraining model complexity, thereby improving reliability when applied to new, unseen data. Specifically, regularisation works by limiting the size of the model coefficients (i.e., the weights of the predictors), reducing the influence of less important variables and shrinking some coefficients to exactly zero, effectively excluding them from the model.

The optimal regularisation parameter (λ) was selected using 10-fold cross-validation, with model fit assessed by minimising the Akaike Information Criterion (AIC). Model performance was evaluated using pseudo-R^2, a measure of explained variance appropriate for count models (McFadden, 1974). The results indicated that the models did not suffer from overfitting and performed reliably across different subsets of the data.

Simulating the effect of different population projections

To generate projections under different population scenarios, a validated and widely used approach, bootstrap resampling, was implemented. Bootstrapping involves repeatedly resampling from the original data with replacement to create simulated datasets, allowing for the estimation of uncertainty around predictions without relying on strong parametric assumptions. The method was applied as follows:

1. First, for each of the target population scenarios, based on the MoJ's official projections for 2025–2029 (89,100; 93,500; 97,300; 99,800; and 100,800 as the projected average yearly prison populations, respectively) (MoJ, 2024b), 1,000 bootstrap samples were generated.
2. For each bootstrap sample:
    a. A realistic distribution of 123 prisons was simulated, reflecting the characteristics of the original dataset.
    b. Prison populations were proportionally scaled to match the target total population.
    c. Occupancy and overcrowding rates were recalculated accordingly.
    d. The fitted negative binomial models were then applied to predict the number of deaths.
3. From the resulting distribution of predicted deaths counts, median values and 95% empirical confidence intervals were calculated to quantify the uncertainty in the projections.
4. These projections were aggregated across different prison types and summarised in a prediction table.

The projections were generated under four key assumptions. First, no substantial policy changes affecting the prison system were expected to occur during the projection period. Second, the number of prisons and their CNA-based capacities were assumed to remain constant. Third, the projected increase in the prison population was assumed to be distributed proportionally across existing facilities, meaning each prison's population increases by the same percentage. Fourth, the general demographic composition of the prison population was assumed to remain unchanged.

All analyses were conducted in R (version 4.1.0), using the *mpath* package for regularised negative binomial regression (Wang et al., 2020) and *ggplot2* for visualisation (Wickham, 2016). Custom bootstrap simulations were implemented using *dplyr* and *tidyr* for data manipulation (Wickham et al., 2022). For the cluster analysis and associated visualisations, Python 3.12 was used, employing the scikit-learn (Pedregosa et al., 2011) and matplotlib (Hunter, 2007) libraries.

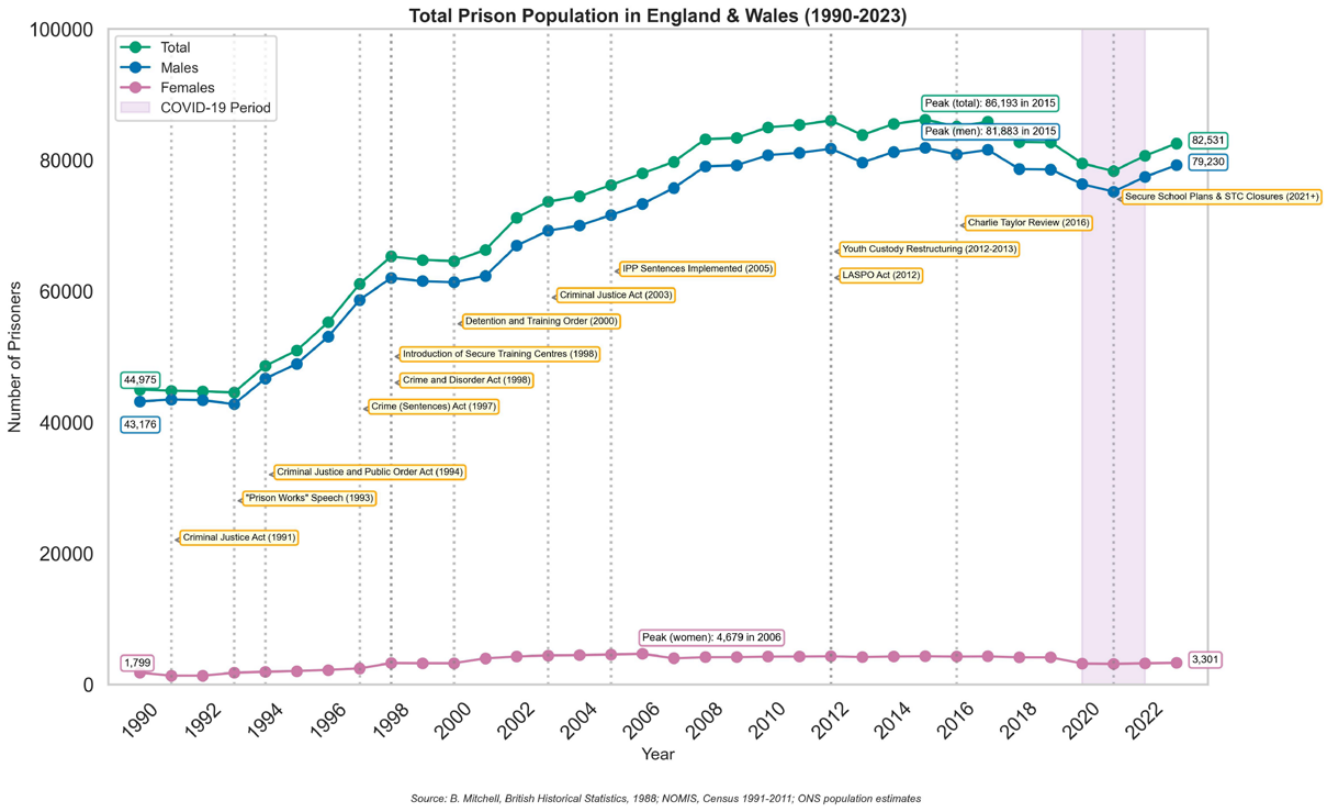
The full analysis code is available in a public GitHub repository (Yukhnenko, 2025).

Findings

Prison population trends and policy context

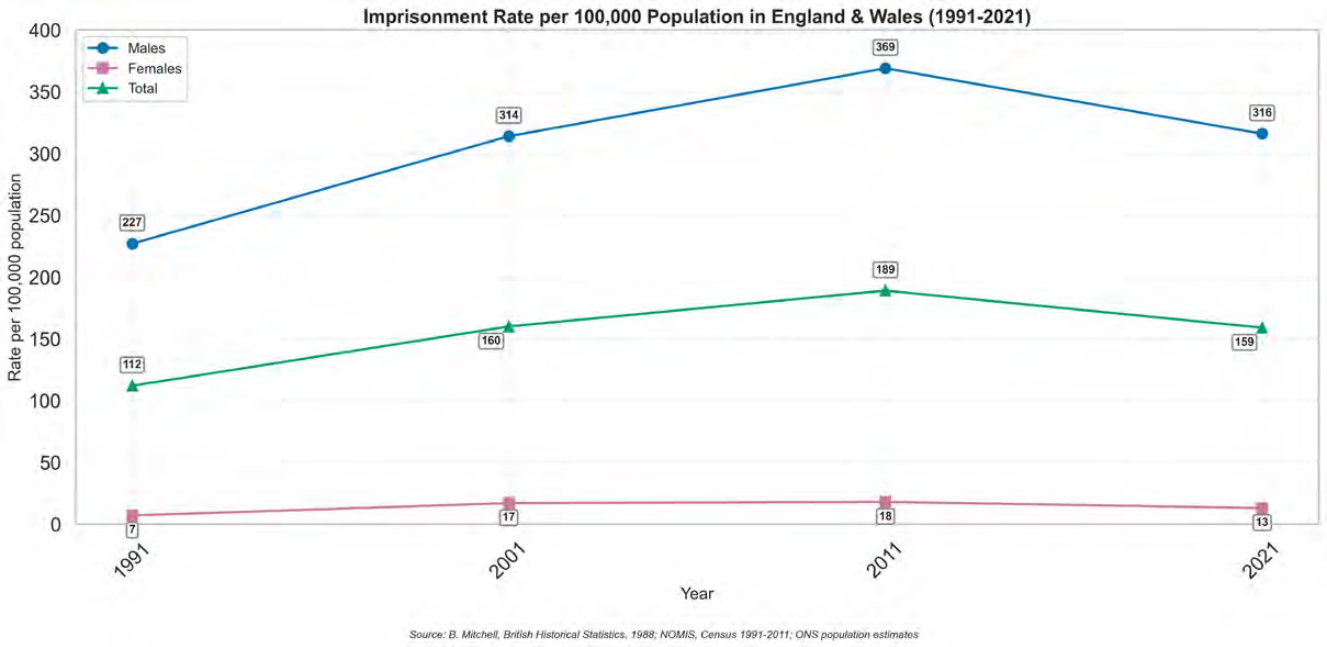
The prison population and imprisonment rates in England and Wales have fluctuated significantly over the past three decades (Fig. 1–2). From 1990 to 2012, the number of individuals in prison nearly doubled, from approximately 45,000 to over 86,000 inmates, reflecting changes in criminal justice policies and growth in the general population. This expansion was particularly pronounced during the mid-1990s and following subsequent legislative reforms. After peaking in 2012, the prison population experienced a modest decline and then plateaued, with a brief interruption during the COVID-19 pandemic. By 2023, the population had stabilised at around 82,500 (although has increased to 87,919 in the latest MoJ official statistics).

Figure 1: Prison Population Trends in England & Wales (1990-2023)



Key policy changes driving these trends include the Criminal Justice Act 1991, which initially attempted to reduce custody for less serious offences, followed by the Criminal Justice and Public Order Act 1994, which imposed stricter penalties. The Crime (Sentences) Act 1997 introduced mandatory minimum sentences for repeat serious offences, while the Criminal Justice Act 2003 established Indeterminate Sentences for Public Protection (IPP), significantly contributing to population growth. The Legal Aid, Sentencing and Punishment of Offenders Act 2012 ended new IPP sentences, though existing IPP prisoners remained subject to Parole Board decisions. The COVID-19 pandemic (2020-2022) led to temporary reductions through emergency measures including early release schemes and court delays.

Figure 2: Imprisonment rates in England and Wales in 1991, 2001, 2011, 2021.



Note. Estimates from B. Mitchell and the Office for National Statistics reported in Sturge (2024, July 8).

Over the past two decades, the gender composition of the prison population has remained consistent, with males constituting 94–97% of all prisoners. In contrast, the age composition has changed notably (Figures 3, 4). The proportion of prisoners aged over 50 has more than doubled, from 7% in 2002 to 18% in 2024, while the proportion of younger prisoners (aged 15–29) has declined from 53% to 33%. In absolute terms, the number of prisoners aged 50 and over has tripled, rising from 4,824 to 15,620, whereas the number of prisoners aged 15 - 20 has fallen from 10,923 to just 3,554.

Figure 3: The England and Wales prison population by age group: absolute numbers (2002-2024)

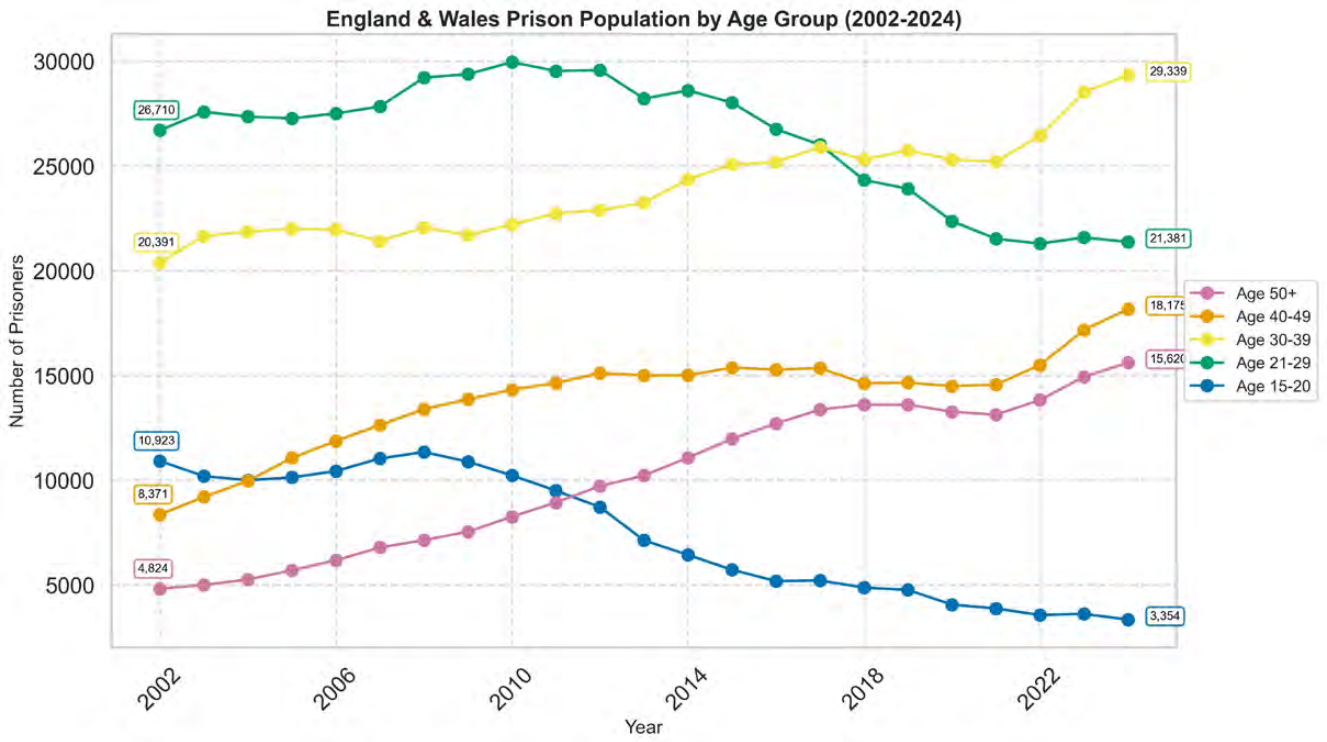
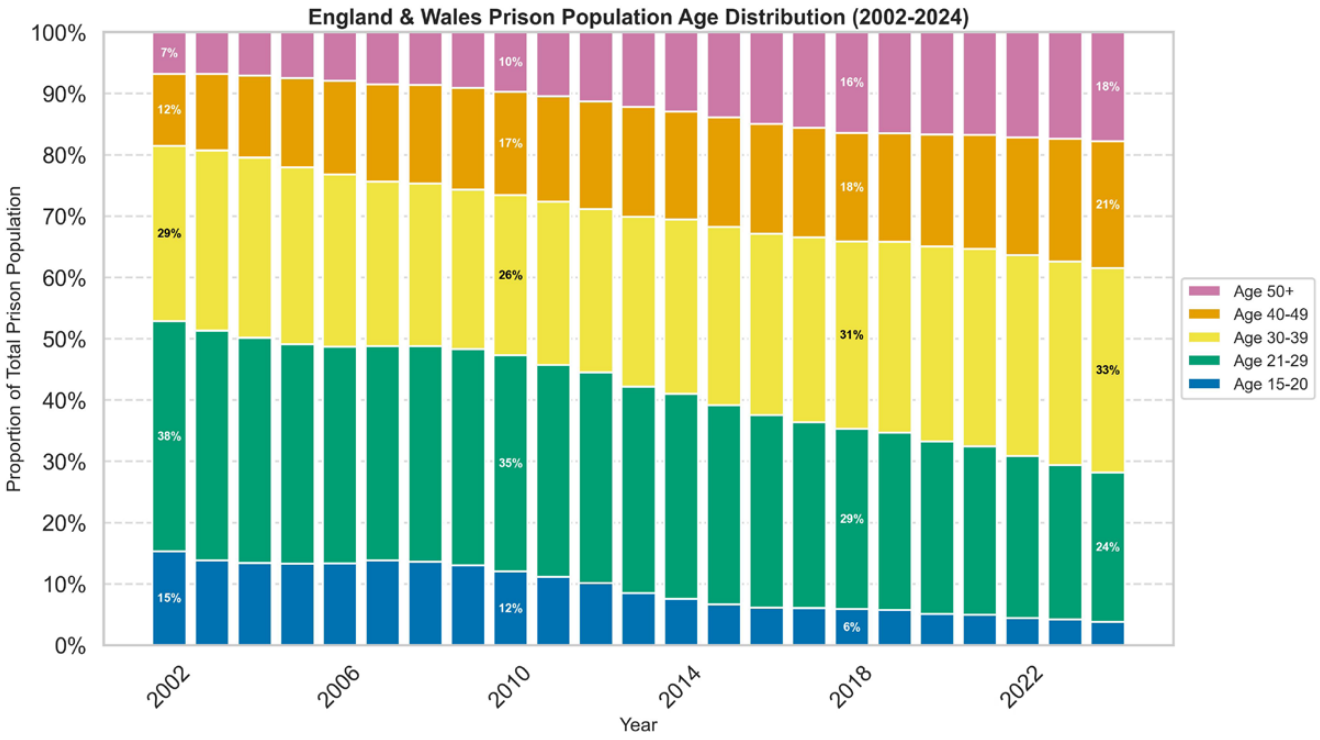


Figure 4: The England and Wales prison population by age group: proportional distribution (2002-2024)

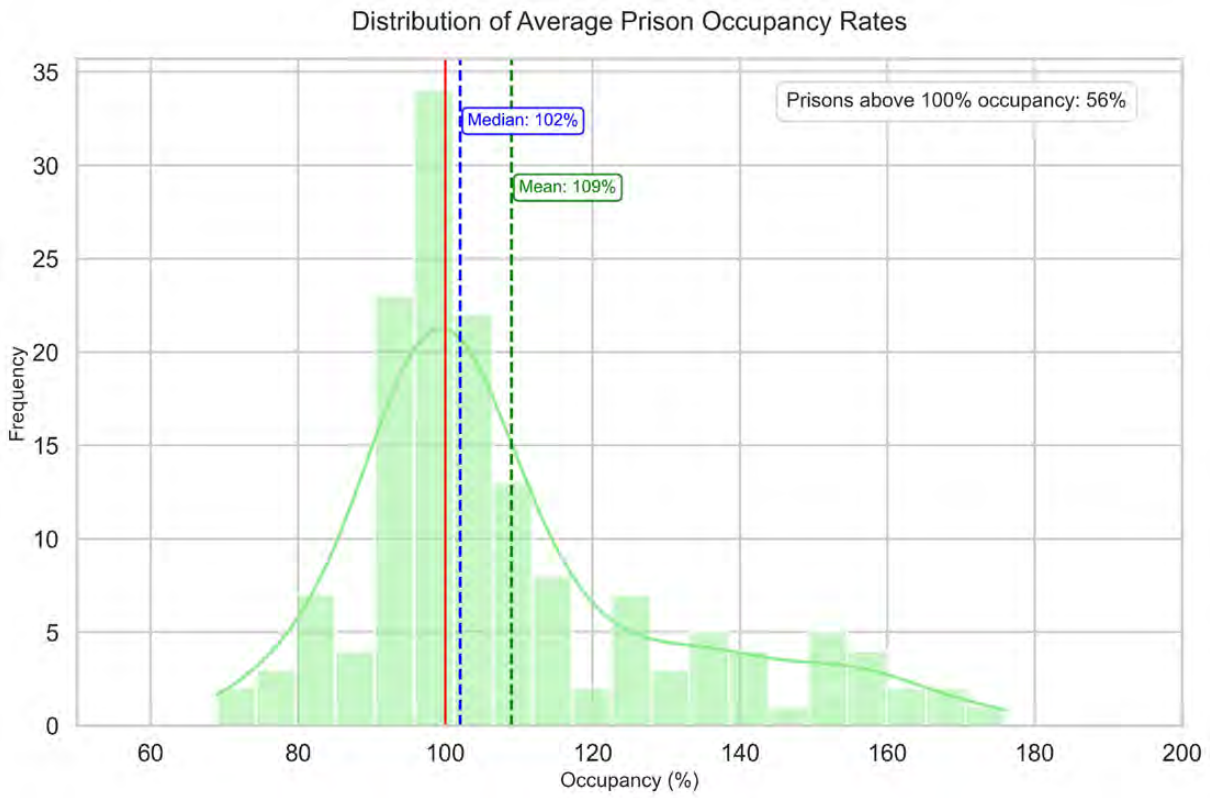


Prison capacity and overcrowding

The aggregated average prison capacity data from 2014 to 2024 demonstrate that many prisons England and Wales operate substantially over their certified normal accommodation (CNA) (Fig. 5). While most overcrowded facilities operate between 100-120% of capacity, a substantial minority maintain occupancy rates exceeding 120%, indicating substantial space constraints.

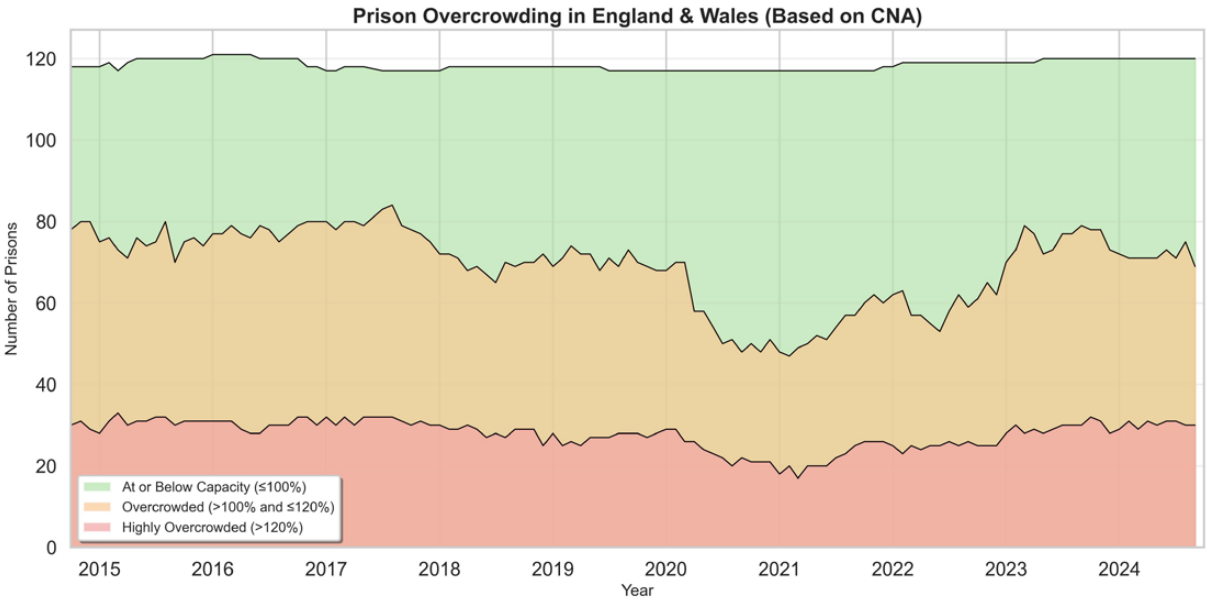
Although the average operational capacity fluctuates over the observational period, overcrowding has been a persistent issue during the observational period from 2014 to 2024, with only a temporary reduction during 2020-2021 due to COVID-19 pandemic measures (Fig. 6). By 2024, the pattern had reverted to pre-pandemic levels, with approximately 75 prisons (56% of the estate) operating above capacity. This sustained overcrowding presents ongoing operational challenges and might adversely affect institutional safety, the provision of healthcare services, and the effectiveness of rehabilitation efforts across the prison system.

Figure 5: Distribution of prison occupancy rates in England and Wales (2014-2024).



Note. The histogram shows the distribution of average occupancy rates (%) across 136 prison sites (including some no longer operational) in England and Wales during the observation period from 2014 to 2024. The red vertical line at 100% denotes the CNA threshold, above which prisons are considered overcrowded.

Figure 6: Temporal trends in prison overcrowding in England and Wales (2014-2024).



Note. Capacity is measured as the ratio of the prison population to CNA.

Deaths in custody

Deaths in prisons in England and Wales are regularly reported and classified into four categories: homicides, self-inflicted, deaths from natural causes, and deaths from other causes (MoJ, 2025). With natural causes accounting for approximately 60% of all prison deaths, the ageing prison population has become a key contributor to overall mortality patterns. Older individuals face significantly higher risks of death due to age-related conditions such as cardiovascular disease, cancer, and chronic respiratory illnesses.

As shown in Figure 7, the death rate from natural causes has diverged notably between crude and age-standardised rates over time. By 2024, the crude mortality rate (1.2 deaths per 1,000 prisoners) was roughly double the age-standardised rate (0.6 per 1,000), indicating a substantial contribution of demographic shifts into the number of deaths from natural causes in prisons.

In contrast, self-inflicted deaths, homicides, and other deaths, which include drug-related fatalities and deaths from undetermined causes, exhibit minimal differences between crude and age-standardised rates. This suggests that non-natural deaths in custody are largely independent of age structure and more likely to be driven by situational, behavioural, or institutional factors.

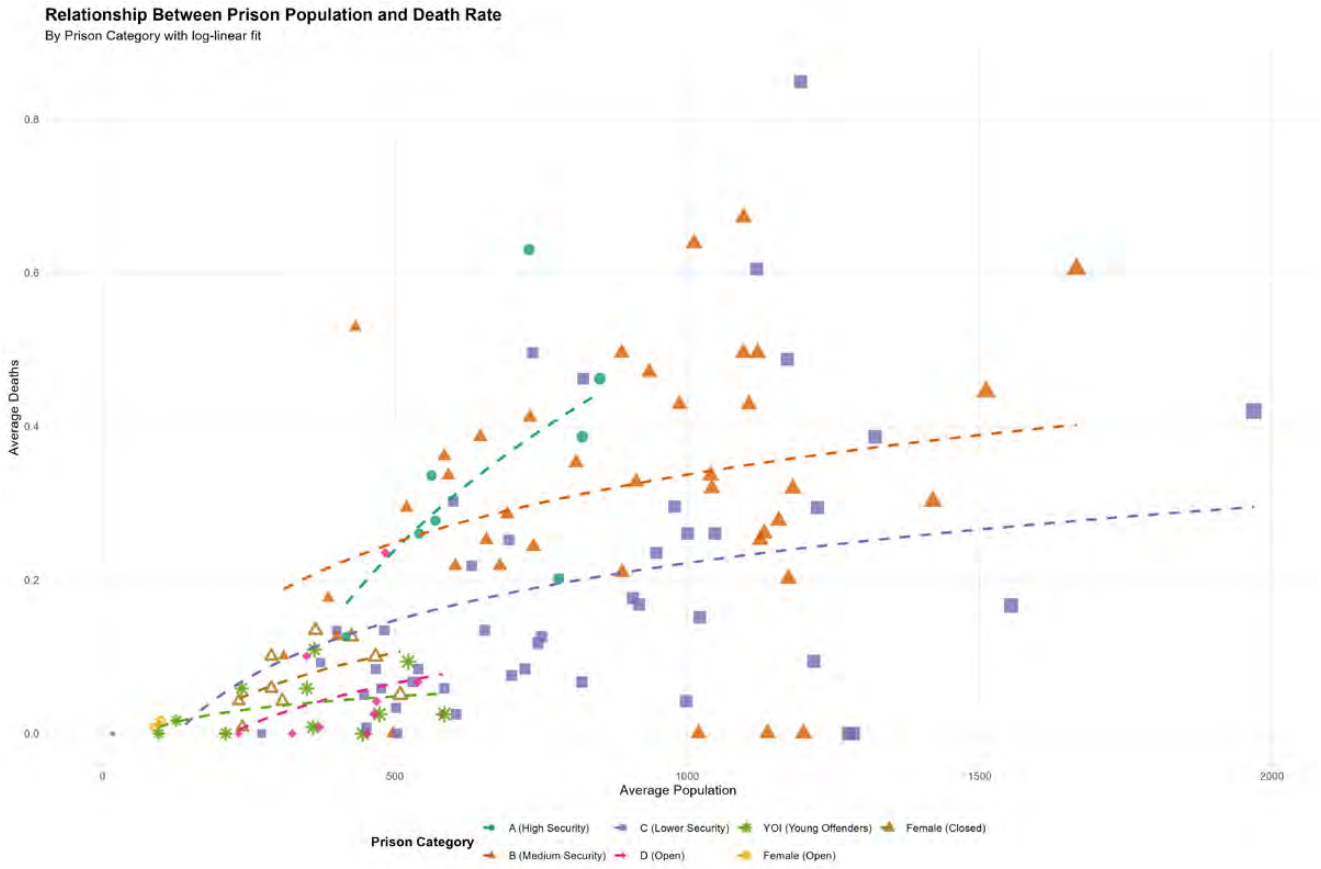
Figure 7: Three-year moving average (3Y MA) of prison death rates in England and Wales, by cause of death (2002–2024)

Note. Death rates are reported per 1,000 prisoners.

Relationship between mortality and occupancy rates in prisons

Prison mortality rates demonstrate distinct patterns when examined in relation to population size and occupancy levels. As expected, increases in prison population size are generally associated with higher average numbers of deaths. Larger prisons tend to record more deaths on average, although substantial variation exists within each security category, and the strength of the observed association varies across prison types (Figure 8).

Figure 8: Relationship between prison population and average number of deaths from any cause by prison category (2014-2024).



Note. Dashed lines represent logarithmic trend lines (y ~ log(x + 1)) fitted to account for overdispersion in count data. This logarithmic transformation was selected to address the fanning pattern observed in the data, where variance increases with the mean.

Figure 9 illustrates varying patterns of association between overcrowding and deaths across prison types. In Category B prisons, occupancy above capacity (>100%) is associated with progressively higher average deaths, particularly in highly overcrowded facilities (>120% occupancy). In contrast, Category C establishments display a relatively flat trend line across occupancy levels. YOIs and women's prisons do not appear to be overcrowded and show little variability in occupancy rates. These patterns suggest that any effective predictive model of mortality must account for prison category-specific effects to accurately capture these associations.

Figure 9: Relationship between prison occupancy proportion (prison population/baseline CNA) and average number of deaths from any cause by prison category (2014-2024)

Note. The plot displays weighted log-linear regression lines for each prison category. The logarithmic transformation of occupancy percentage (x-axis) helps capture non-linear relationships. The model is weighted, giving greater influence on larger prisons in determining the trend lines. Color-coded regions represent different occupancy levels: green (below capacity, <100%), yellow (medium overcrowding, 100-120%), and red (high overcrowding, >120%). Marker size is proportional to prison population.

Prediction of deaths in prisons

Performance

A total of six prediction models were developed to examine the associations between prison characteristics, overcrowding, and mortality outcomes. Model performance varied across mortality categories, which can be estimated in the pseudo-R^2 values reported in Table 1. Pseudo-R^2 indicates how well a statistical model explains variation in the outcome variable, functioning similarly to the traditional R^2 in linear regression. For example, a pseudo-R^2 value of 0.61 means that approximately 61% of the variation in self-inflicted deaths is explained by the model's predictors. Unlike standard R^2, pseudo-R^2 values tend to be lower, with values above 0.3 generally considered meaningful in applied settings.

None of the models utilised the full set of predictors; depending on the outcome, between 1 and 14 variables were selected out of possible 23. Results from 10-fold cross-validation indicated that overfitting was avoided. The model predicting self-inflicted deaths demonstrated the strongest performance (pseudo-R^2 = 0.61), followed by models for other deaths (pseudo-R^2 = 0.55) and total deaths (pseudo-R^2 = 0.52). The model for natural deaths performed moderately well (pseudo-R^2 = 0.33), while the model predicting homicides showed virtually no explanatory power (pseudo-R^2 = 0.01), indicating that the included predictors were not informative for this outcome. This likely reflects the rarity of homicide events in the prison context. In England and Wales, three homicides were reported in prison during the first three quarters of 2024, and only two in the whole of 2023. As a result, the homicide model was excluded from further analysis, and homicides were combined with other deaths into a single category: other deaths (including homicides).

Table 1: Predictive performance of elastic net-penalised negative binomial models for prison mortality outcomes

Outcome Measure	Pseudo-R^2	No. Selected Variables
Total Deaths	0.52	11
Homicides	0.01*	1
Self-Inflicted	0.61	14
Natural Deaths	0.33	10
Other Deaths	0.55	13
Other Deaths (incl. Homicides)	0.53	12

Note. * The model for homicides yielded a very low pseudo-R^2 (0.01) due to rarity of the outcome. This model was excluded from further analysis.

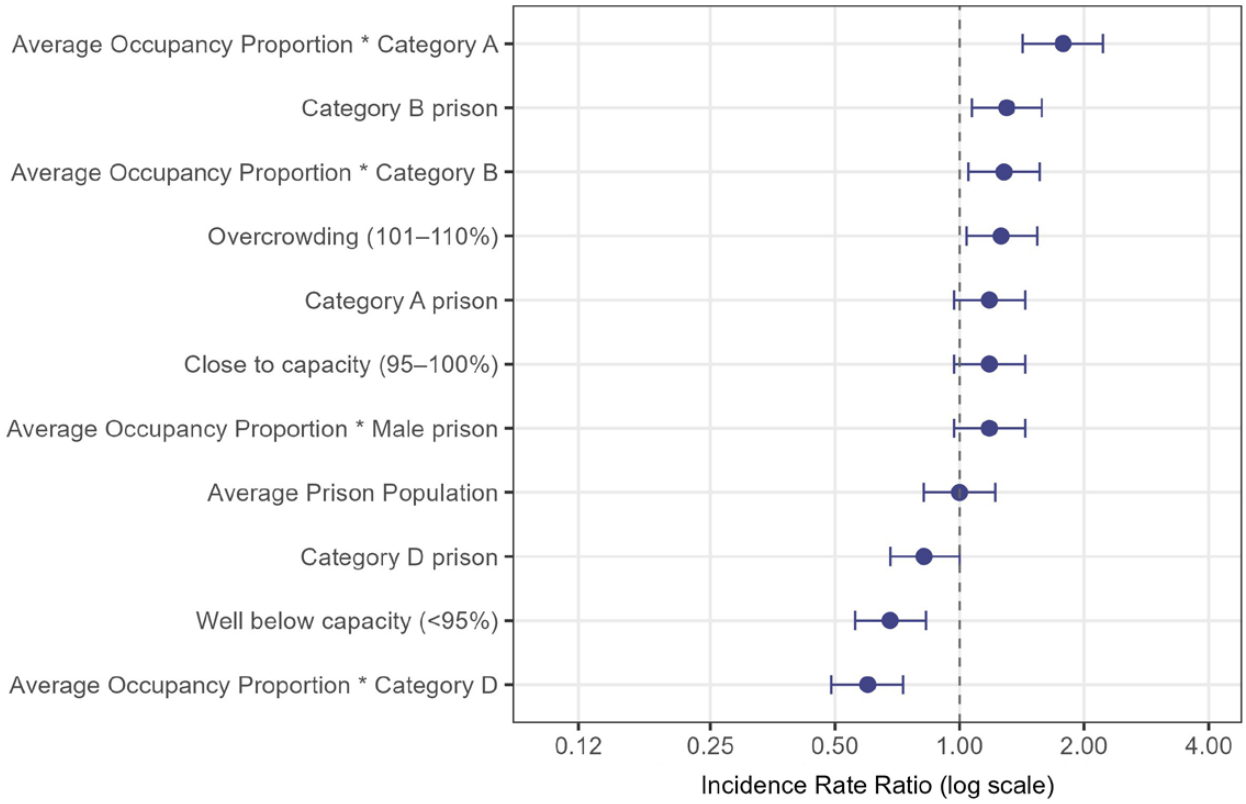
Model coefficients

The associations between prison characteristics, overcrowding, and mortality outcomes were modelled using regularised negative binomial regression models. The model coefficients, presented in Figure 10 as incidence rate ratios (IRRs), reflect the estimated effect of each predictor on the number of deaths from any cause after accounting for other variables in the model. The model specifications for each outcome are reported in Supplement 2.

Given the complexity of interactions and the potential for multicollinearity (that individual variables are correlated with each other) among covariates, individual IRRs should not be interpreted in isolation. In general, IRRs above 1 suggest an increased risk relative to the reference group, while those below 1 indicate a potential protective effect. However, in predictive modelling, especially when including interaction terms and potential multicollinearity, IRRs should not be interpreted in isolation. Each IRR reflects the estimated effect of a variable while holding others constant, which may not reflect realistic scenarios when interactions are present. The primary aim of the predictive modelling is predictive utility, rather than the precise estimation of independent, unbiased causal effects.

That said, several patterns in the model outputs offer useful insights for prediction. Prison category is a strong predictor of mortality risk. Category B prisons are associated with higher rates of natural deaths (IRR = 1.34, 95% CI: 1.10–1.63), other deaths (IRR = 1.46, CI: 1.20–1.78), and other deaths including homicides (IRR = 1.59, CI: 1.31–1.94). Category A prisons also show elevated risks, particularly for other deaths (IRR = 1.37, CI: 1.13–1.67), though associations with total and natural deaths are more modest. In contrast, Category D prisons are linked to consistently lower mortality, including self-inflicted deaths (IRR = 0.51, CI: 0.39–0.67) and other deaths (IRR = 0.75, CI: 0.62–0.92). Closed female prisons are associated with increased self-inflicted deaths (IRR = 1.70, CI: 1.38–2.10). YOIs have a lower baseline risk of self-inflicted deaths (IRR = 0.75), but this risk increases with occupancy (interaction IRR = 1.31), suggesting potentially heightened sensitivity to overcrowding.

Figure 10: Estimated coefficients (presented as incidence rate ratios) from a developed model predicting the total number of deaths in prisons in England and Wales



Note. * Overcrowding levels are defined relative to the CNA. IRRs to the right of the dashed line indicate elevated risk of death; IRRs to the left indicate reduced risk.

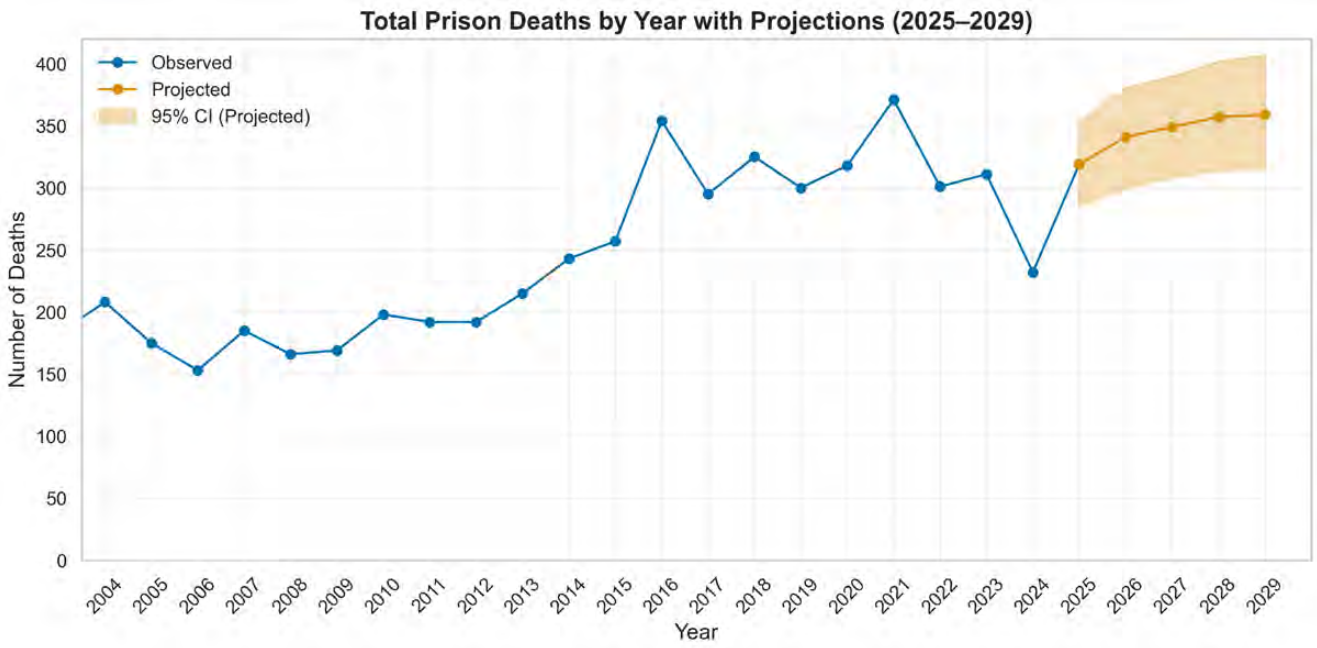
Overcrowding covariates also contribute to predictive accuracy. Prisons operating below 95% capacity show lower risks of total deaths (IRR = 0.68, CI: 0.56–0.83) and natural deaths (IRR = 0.58, CI: 0.47–0.72). In contrast, modest overcrowding (101–110%) is associated with increased risks of total (IRR = 1.26, CI: 1.04–1.54) and natural mortality (IRR = 1.21, CI: 1.00–1.47). However, extreme overcrowding (>120%) s linked to reduced rates of self-inflicted deaths (IRR = 0.78) and other deaths (IRR = 0.52). This counterintuitive pattern may reflect collider bias, unmeasured confounding, or adaptive operational practices in severely overcrowded settings. Notably, all prisons in this category were either Category B or C, suggesting these effects may be context-specific rather than generalisable across prisons.

Interaction terms reveal that the impact of overcrowding varied by prison type. In Category A prisons, higher occupancy is linked to increased mortality, including total (IRR = 1.78) and self-inflicted deaths (IRR = 1.87). A similar trend appears in Category B prisons, especially for self-inflicted deaths (IRR = 2.36). By contrast, in Category D prisons, higher occupancy is associated with lower mortality, e.g., natural deaths (IRR = 0.73) and other deaths (IRR = 0.57), indicating a distinct institutional context or a potentially confounded estimate.

Projected deaths in custody (2025-2029)

Bootstrap simulations were used to project mortality outcomes based on the official Prison Population Projections for England and Wales (2024–2029), published by the MoJ (2024a). Median projected annual deaths, along with empirical 95% confidence intervals, are provided for each year in Supplement 3, stratified by prison type and cause of death. These projections are also visualised in Figure 11.

Figure 11: Total prison deaths in England and Wales by year, including projections for 2025–2029



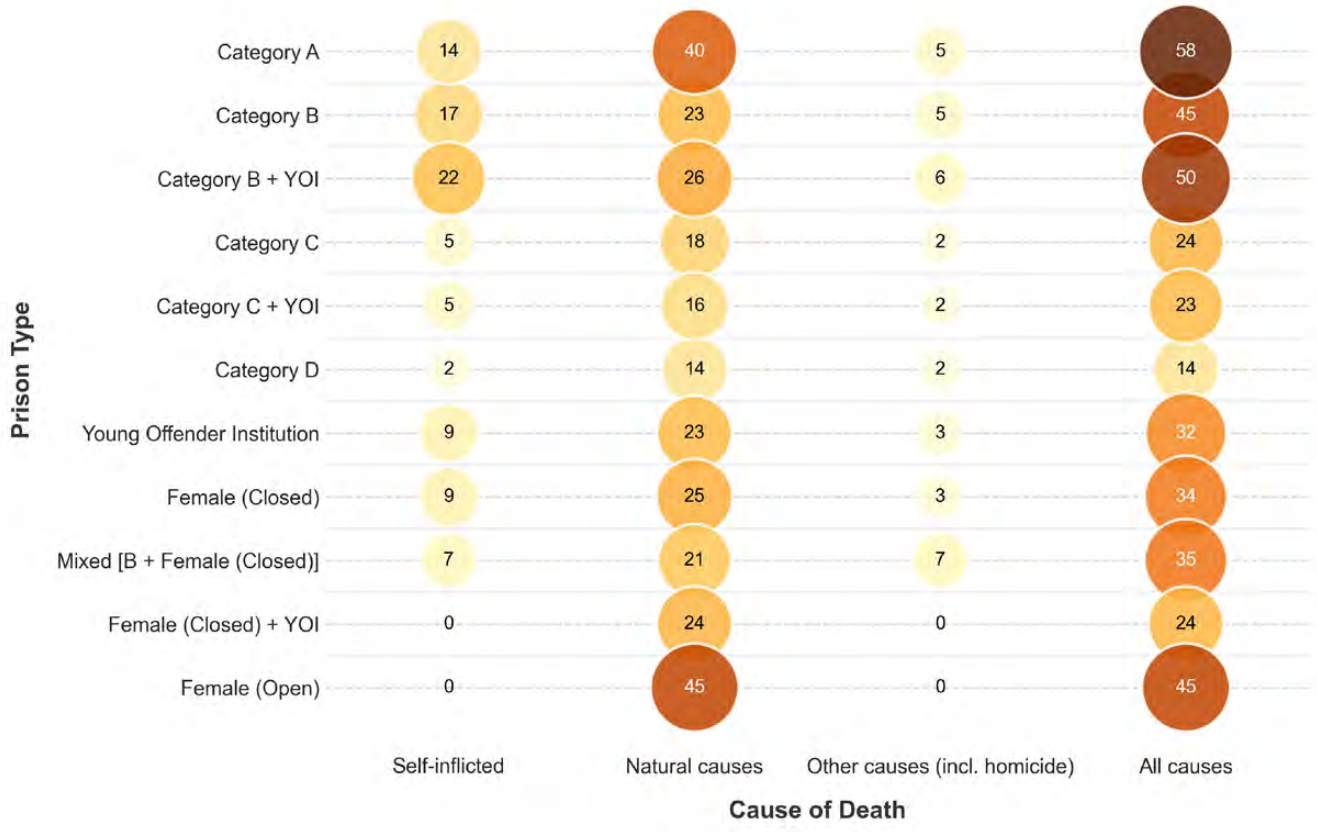
Note. Data sourced from MoJ records on deaths in custody (2024a).

Under the specified assumptions (see Methods, section Bootstrap simulation for population projections), the projections suggest that, assuming a 13% increase in the total prison population from 89,100 in 2025 to 100,800 in 2029, the number of deaths will change:

- Total annual deaths are expected to increase by 13% (from 319 to 359)
- Deaths from natural causes are expected to increase by 12% (from 200 to 223)
- Self-inflicted deaths are expected to increase by 21% (from 89 to 108)
- Other deaths, including homicides, are expected to increase by 12% (from 33 to 37)

The largest absolute increases are projected to occur in Category B prisons, which accommodate a significant proportion of the prison population. In these establishments, total deaths are expected to rise from 146 to 165 (a 13% increase), with a particularly notable increase in self-inflicted deaths from 52 to 62.4 (a 25% increase).

Figure 12: Total prison deaths in England and Wales by year, including projections for 2025–2029



Note. Projections are based on prison population and expected deaths in 2029. Data rounded to the nearest whole number.

Figure 11 further illustrates that projected death rates vary substantially across prison types even after adjusting for population size. Differences in mortality patterns by cause, such as self-inflicted deaths versus natural causes, highlight the distinct risk profiles associated with different institutional settings.

Conclusion

This report presents the results of an analysis examining the association between prison overcrowding and deaths in custody across England and Wales over a ten-year period (2014–2024). Conducted in the context of a prison system operating near or above capacity, with many institutions facing sustained overcrowding, the analysis finds that overcrowding is systematically associated with increased mortality across most prison categories with some exceptions. These associations are shown to vary by both prison category and cause of death.

Additionally, a predictive modelling approach was used to estimate mortality risks under different levels of occupancy and institutional conditions, and to project future deaths based on prison population forecasts published by the Ministry of Justice. The annual number of deaths from external causes (mostly self-inflicted and accidental), all of which are potentially preventable, is projected to increase from 122 in 2025 to 145 in 2029 (by 19%). Deaths from natural causes are also expected to rise, from 200 in 2025 to 223 in 2029 (by 12%), some of which may also be preventable. The projected 21% (from 89 to 108 deaths) annual increase in self-inflicted mortality is particularly concerning, given the persistent challenges surrounding mental health provision in prisons. Although the confidence intervals reflect some uncertainty in these projections, even the lower bounds suggest notable increases in mortality.

Most deaths are projected to occur in Category B and C prisons, which together account for approximately 64% of total deaths across all projection scenarios. These prison categories also experience the highest average levels of overcrowding across the estate. Moreover, Category B prisons, despite housing fewer prisoners than Category C ones, are projected to account for a greater number of self-inflicted and natural deaths. This highlights the need to target preventive measures and expand healthcare provision in these high-risk settings to mitigate the impact of rising prisoner numbers.

Overall, the drivers of mortality differ by prison type. Overcapacity in closed male facilities is strongly associated with an elevated risk of self-inflicted deaths, whereas no similar relationship is observed in female or open prisons, where overcrowding is less prevalent.

Understanding the causal mechanisms of prison mortality, particularly those linking modifiable environmental and institutional factors to preventable deaths, is essential for designing effective interventions. Among other factors, self-harm and assault data, which are routinely collected and reported, represent key indicators that may help explain some of these patterns. For an overview of self-harm and assault trends as potential contributors to mortality, see Supplement 4.

More detailed research using establishment-level data is needed to clarify the pathways through which prison environments influence mortality, particularly in relation to overcrowding, self-harm, assaults, and access to healthcare. To support this, the national prison service must take a proactive role in enabling independent research by routinely sharing relevant data with external research teams that have a proven track record in high-quality epidemiological analysis. The MoJ should consider funding this work as it falls outside traditional funder's areas. Strengthening collaboration between academic and institutional stakeholders is critical to developing evidence-based strategies to reduce preventable deaths in custody.

Taken together, these findings underscore the need for coordinated policy responses that balance public safety with the imperative to protect the health and wellbeing of people in custody. If prison populations continue to grow without corresponding increases in capacity, staffing, and healthcare services, existing pressures will likely intensify-raising the risk of preventable deaths.

In light of this new evidence, three strategic priorities can be considered: (1) expanding healthcare provision, especially mental health services, in high-risk settings such as Category B male prisons; (2) targeting suicide and self-harm prevention efforts in establishments with occupation rates close to or above 100%, where risks are most acute; and (3) enabling research to investigate the mechanisms linking overcrowding, violence, self-harm, and mortality. Routine data sharing with independent researchers will be vital to ensuring that future strategies are grounded in robust evidence and focused on prevention.

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Supplement 1. Deaths in prisons during COVID-19 pandemic

The COVID-19 pandemic introduced widespread and atypical disruptions to prison regimes, including substantial changes in operational procedures, population levels, and health outcomes. Therefore, the inclusion of data from this period in a training dataset for predictive modelling may bias the estimation of general mortality trends in custodial settings. To estimate the potential contribution of COVID-19-related mortality, a longitudinal analysis of monthly prison-level mortality was conducted using Generalised Estimating Equations (GEE) with a Poisson link function. The GEE approach was chosen for its ability to account for correlated observations within prison clusters and to handle temporal autocorrelation-both expected features of panel data of this nature.

Methods

The pandemic period was segmented into three analytically distinct phases, reflecting evolving operational responses within prisons:

- Acute COVID period: 1 March 2020 – 15 September 2020
- Residual COVID period: 16 September 2020 – 15 June 2021
- Ending COVID period: 16 June 2021 – 31 March 2022

Binary indicators for each of the phases were created and included as covariates in the model. The model accounted for repeated monthly observations nested within prisons, using an autoregressive (AR1) working correlation matrix to reflect likely temporal dependence. The outcome variable was the number of total deaths per month per prison.

GEE Regression Results

Variable	Coefficient (β)	Std. Error	z-value	p-value	95% CI
Intercept	-1.5457	0.076	-20.236	<0.001	[-1.695, -1.396]
Acute COVID	0.0188	0.078	0.240	0.810	[-0.134, 0.172]
Residual COVID	**0.3031**	**0.070**	**4.360**	**<0.001**	**[0.167, 0.439]**
Ending COVID	-0.0323	0.066	-0.489	0.625	[-0.162, 0.097]

During the residual COVID period, mortality was found to be significantly elevated, with an estimated increase of approximately 35% compared to non-COVID periods (exp(0.3031) ≈ 1.35). No statistically significant increase was observed during the acute or ending COVID phases.

Conclusions

The results indicate that the residual phase of the COVID-19 pandemic was associated with a systematically elevated level of prison mortality. This period is therefore not considered representative of long-term or typical conditions within the custodial environment. However, the complete exclusion of these data may obscure meaningful effects related to systemic stress or institutional adaptation. It is therefore recommended that observations from the residual COVID period be retained in the dataset, but that their influence be moderated during trend estimation or predictive modelling.

Specifically, in time-weighted models, weights applied to this period should be reduced to approximately 70–75% of the full weight. This adjustment corresponds to the inverse of the observed relative increase in deaths (1 / 1.35 ≈ 0.74), thereby approximating a neutralised contribution to overall trend estimation. Alternatively, when modelling time-series data, an interaction term involving the residual COVID indicator and either time or prison category may be introduced in more flexible modelling frameworks to estimate and adjust for potential distortions.

This approach ensures that recent observations continue to inform predictions, while pandemic-related anomalies are appropriately accounted for.

Supplement 2. Prediction model specification

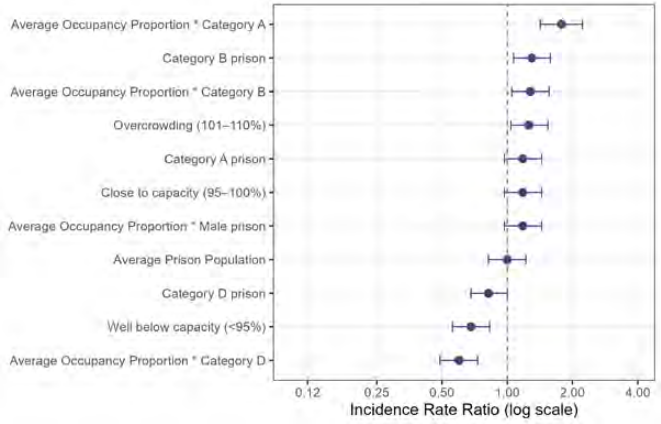
This table presents incidence rate ratios (IRRs) and 95% confidence intervals (CIs) from elastic net-penalised multivariate negative binomial regression models predicting different mortality outcomes in prison population. IRRs above 1 indicate an increased risk, while values below 1 suggest a reduced risk, relative to the reference group or baseline. For example, an IRR of 1.30 for *Category B* indicates a 30% higher incidence rate of the outcome in *Category B* prisons relative to the reference group, which is implicitly defined as the combination of zero values for all other category dummies - i.e., not *A*, not *D*, not *B*, etc. To convert IRRs back to model coefficients, use the transformation: $\beta = ln(IRR)$.

Empty cells indicate that the corresponding variable was not selected in the final model for that outcome - either because its effect was negligible, collinear, or redundant with other variables under the penalisation scheme. Interaction terms (e.g., *Average Occupancy Proportion * Category A*) capture the moderating effect of prison occupancy on death rates by prison type. Due to potential complex relationships between covariates in the model, individual coefficient values should not be interpreted in isolation.

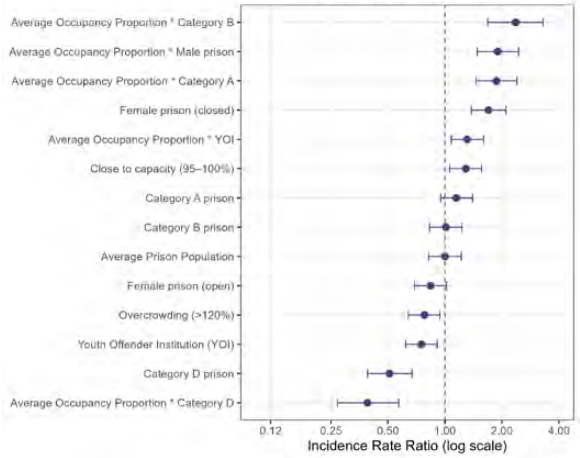
Variable	Total Deaths	Self-Inflicted	Natural Deaths	Other Deaths	Other Deaths (incl. Homicides)
Category A prison	1.18 (0.97–1.44)	1.15 (0.95–1.40)	1.21 (0.99–1.47)	1.37 (1.13–1.67)	1.32 (1.09–1.61)
Category B prison	1.30 (1.07–1.58)	1.01 (0.83–1.23)	1.34 (1.10–1.63)	1.46 (1.20–1.78)	1.59 (1.31–1.94)
Category D prison	0.82 (0.68–1.00)	0.51 (0.39–0.67)	0.96 (0.79–1.16)	0.75 (0.62–0.92)	0.69 (0.57–0.84)
Average Prison Population	1.00 (0.82–1.22)	1.00 (0.82–1.22)	1.00 (0.82–1.22)	1.00 (0.82–1.22)	1.00 (0.82–1.22)
Well below capacity (<95%)	0.68 (0.56–0.83)	-	0.58 (0.47–0.72)	0.26 (0.15–0.44)	0.62 (0.51–0.76)
Close to capacity (95–100%)	1.18 (0.97–1.44)	1.29 (1.06–1.56)	-	1.04 (0.85–1.26)	-
Overcrowding (101–110%)	1.26 (1.04–1.54)	-	1.21 (1.00–1.47)	-	1.02 (0.84–1.24)
Average Occupancy Proportion * Category A	1.78 (1.42–2.22)	1.87 (1.46–2.40)	1.70 (1.38–2.10)	1.30 (1.07–1.58)	1.38 (1.13–1.67)
Average Occupancy Proportion * Category B	1.28 (1.05–1.56)	2.36 (1.68–3.30)	-	1.49 (1.22–1.81)	1.32 (1.08–1.60)
Average Occupancy Proportion * Category D	0.60 (0.49–0.73)	0.39 (0.27–0.57)	0.73 (0.60–0.88)	0.57 (0.46–0.71)	0.63 (0.51–0.76)
Average Occupancy Proportion * Male prison	1.18 (0.97–1.44)	1.90 (1.48–2.45)	-	1.10 (0.90–1.34)	-
Youth Offender Institution (YOI)	-	0.75 (0.62–0.91)	-	1.21 (1.00–1.48)	-
Female prison (closed)	-	1.70 (1.38–2.10)	-	-	-
Female prison (open)	-	0.84 (0.69–1.02)	-	-	-
Overcrowding (>120%)	-	0.78 (0.64–0.94)	-	0.52 (0.40–0.67)	0.63 (0.52–0.77)
Average Occupancy Proportion * YOI	-	1.31 (1.08–1.60)	-	1.11 (0.91–1.35)	1.14 (0.94–1.38)
Male prison	-	-	1.11 (0.91–1.35)	-	1.02 (0.84–1.24)
Overcrowding (111–120%)	-	-	0.96 (0.79–1.16)	-	-

The forest plots present the same information as above. The estimates were derived from multivariate analysis and should not be interpreted independently of each other.

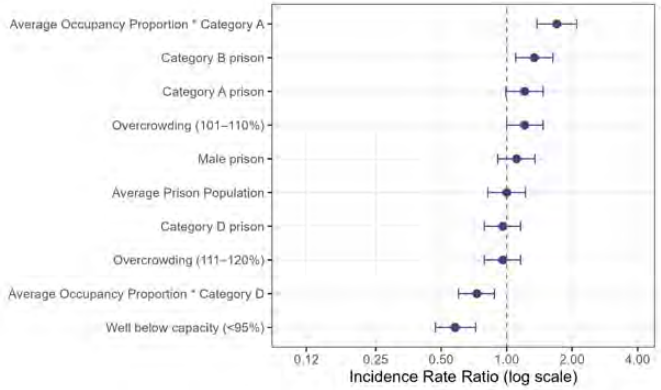
Total deaths



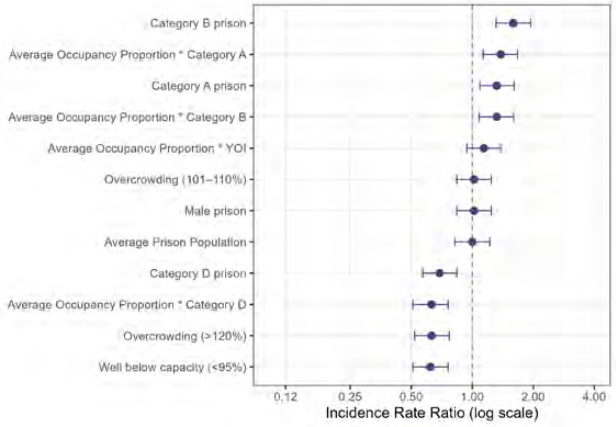
Self-inflicted



Natural causes



Other (including homicide)



The models were specified as follows:

$$\log(E[Y]) = \beta_0 + \sum_{j=1}^{p} \beta_j X_j + \sum_{k=1}^{q} \gamma_k (Z_k \times \text{OccupancyProportion})$$

Where Y represents the count of deaths (by category), X_j denotes the main covariates (such as prison type, gender, population size, and overcrowding status), and Z_k represents variables included in interaction terms with the occupancy proportion. The exponentials of coefficients (e^{β}) can be interpreted as IRRs.

Supplement 3. Projected prison mortality in England and Wales

Predicted estimates for mortality outcomes in prisons were derived using penalised negative binomial regression models fitted to historical data across all prison establishments in England and Wales. Models included prison-level covariates such as average population, occupancy rate, and establishment type, with interaction terms accounting for the joint effects of overcrowding and institutional category. These estimates were then applied to projected prison populations, which are expected to increase from approximately 88,000 in 2025 to 100,800 by 2029 (Ministry of Justice, 2024a). The estimates are presented along with empirical 95% confidence intervals, obtained through 1,000-iteration bootstrapping procedure. The confidence intervals reflect prediction variability arising from population structure and distributional noise.

Outcome	Prison Category	Year (projected population size)				
		2025 (89,100)	2026 (93,500)	2027 (97,300)	2028 (99,800)	2029 (100,800)
Total Deaths	C	86 (61-112)	89 (62-119)	88 (60-121)	90 (63-125)	91 (64-124)
	B	118 (80-154)	126 (87-171)	131 (90-175)	137 (90-184)	138 (96-189)
	B+YOI	34 (11-63)	38 (12-72)	40 (12-75)	43 (14-80)	44 (12-81)
	A	30 (12-54)	34 (13-62)	35 (13-62)	35 (13-63)	33 (13-60)
	D	8 (3-12)	8 (4-13)	8 (3-12)	7 (3-12)	7 (3-11)
	C+YOI	10 (2-21)	9 (2-19)	10 (3-20)	10 (3-19)	10 (3-20)
	YOI	11 (4-20)	12 (5-21)	12 (5-21)	12 (5-20)	11 (5-19)
	Female (Closed)	10 (4-17)	10 (4-17)	11 (5-18)	11 (5-18)	11 (5-18)
	Mixed [B + Female (Closed)]	4 (4-16)	4 (4-13)	5 (5-18)	5 (5-19)	5 (5-19)
	Female (Closed) + YOI	1 (1-5)	1 (1-5)	1 (1-4)	1 (1-4)	1 (1-4)
	Female (Open)	1 (1-3)	1 (1-4)	1 (1-4)	1 (1-4)	1 (1-4)
	TOTAL	**319 (285-353)**	**341 (300-381)**	**349 (308-390)**	**357 (314-402)**	**359 (315-407)**
Self-Inflicted Deaths	C	16 (12-20)	17 (12-21)	17 (12-22)	17 (13-22)	17 (13-22)
	B	41 (28-54)	44 (31-60)	47 (33-64)	51 (33-70)	53 (36-72)
	B+YOI	13 (5-24)	16 (5-29)	17 (5-32)	19 (6-34)	19 (6-36)
	A	7 (3-13)	7 (3-13)	7 (3-13)	7 (3-13)	8 (3-14)
	D	1 (0-1)	1 (0-1)	1 (0-1)	1 (0-1)	1 (0-1)
	C+YOI	2 (0-4)	2 (0-4)	2 (1-4)	2 (0-4)	2 (1-4)
	YOI	3 (1-5)	3 (1-5)	3 (1-5)	3 (1-5)	3 (1-5)
	Female (Closed)	3 (1-5)	3 (1-5)	3 (1-5)	3 (1-5)	3 (1-4)
	Mixed [B + Female (Closed)]	1 (1-5)	1 (1-4)	1 (1-4)	1 (1-4)	1 (1-4)
	Female (Closed) + YOI	-	-	-	-	-
	Female (Open)	-	-	-	-	-
	TOTAL	**89 (76-101)**	**95 (80-110)**	**100 (85-118)**	**106 (88-124)**	**108 (89-129)**

Outcome	Prison Category	Year (projected population size)				
		2025 (89,100)	2026 (93,500)	2027 (97,300)	2028 (99,800)	2029 (100,800)
Natual Deaths	C	62 (44-82)	65 (45-88)	65 (43-90)	66 (46-93)	67 (46-92)
	B	63 (43-82)	67 (47-91)	69 (46-92)	71 (47-95)	71 (49-97)
	B+YOI	18 (6-35)	20 (6-38)	21 (6-39)	22 (7-41)	23 (6-42)
	A	20 (8-35)	23 (9-43)	24 (9-43)	24 (9-44)	23 (9-41)
	D	7 (3-11)	8 (4-13)	7 (3-12)	7 (3-12)	7 (3-11)
	C+YOI	7 (1-15)	7 (2-14)	7 (2-14)	7 (2-14)	7 (2-15)
	YOI	7 (3-13)	8 (3-14)	8 (3-14)	8 (3-14)	8 (3-13)
	Female (Closed)	7 (3-11)	7 (3-12)	8 (3-13)	8 (3-14)	8 (4-14)
	Mixed [B + Female (Closed)]	3 (3-10)	3 (3-8)	3 (3-12)	3 (3-12)	3 (3-13)
	Female (Closed) + YOI	1 (1-4)	1 (1-4)	1 (1-3)	1 (1-3)	1 (1-3)
	Female (Open)	1 (0-2)	1 (0-3)	1 (0-2)	1 (0-3)	1 (0-2)
	TOTAL	**200 (180-222)**	**214 (192-239)**	**219 (196-243)**	**223 (198-251)**	**223 (198-250)**
Other including Homicide	C	8 (6-11)	8 (6-11)	8 (6-11)	8 (6-11)	8 (6-11)
	B	13 (8-17)	13 (9-18)	13 (9-18)	14 (9-19)	14 (10-19)
	B+YOI	4 (1-9)	4 (1-9)	4 (1-9)	4 (1-9)	4 (1-9)
	A	2 (1-4)	2 (1-4)	2 (1-4)	2 (1-4)	2 (1-4)
	D	1 (0-1)	1 (0-1)	1 (0-1)	1 (0-1)	1 (0-1)
	C+YOI	1 (0-2)	1 (0-2)	1 (0-2)	1 (0-2)	1 (0-2)
	YOI	1 (0-2)	1 (0-2)	1 (0-2)	1 (0-2)	1 (0-2)
	Female (Closed)	1 (0-2)	1 (0-2)	1 (0-2)	1 (0-2)	1 (0-2)
	Mixed [B + Female (Closed)]	1 (1-3)	1 (1-2)	1 (1-2)	1 (1-2)	1 (1-2)
	Female (Closed) + YOI	-	-	-	-	-
	Female (Open)	-	-	-	-	-
	TOTAL	**33 (29-38)**	**35 (30-42)**	**35 (30-40)**	**36 (31-41)**	**37 (32-43)**

Note. Dashes (–) indicate suppressed zero counts.

Supplement 4. Self-harm and assaults

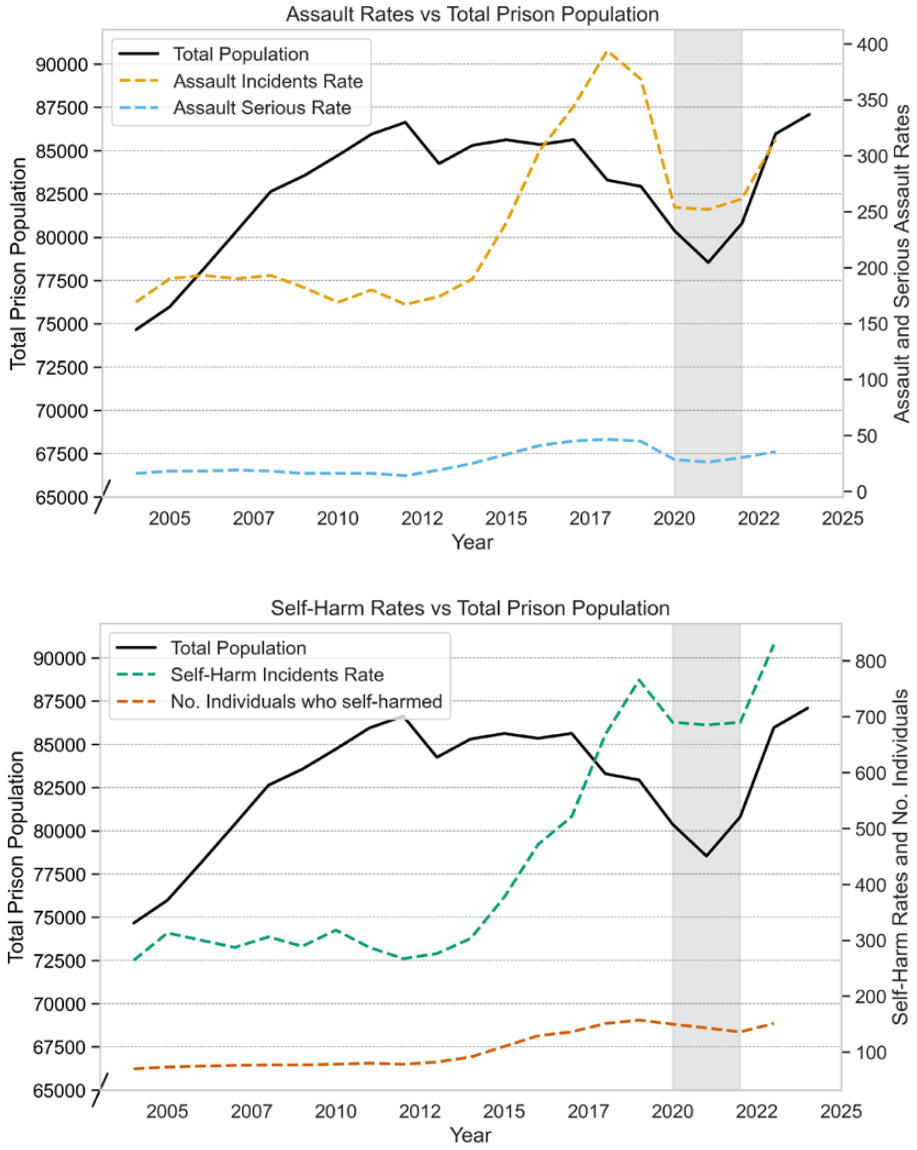
The current study is limited by the absence of individual prison-level data that would allow for more careful examination of how self-harm and violence might function as mediators between overcrowding and mortality. Future research should address this gap by collecting and analysing establishment-specific data on overcrowding, adverse incidents, and mortality outcomes to better understand these potential pathways and inform targeted prevention strategies.

This brief supplementary analysis explores trends in self-harm and assaults in prisons in England and Wales as potential indicators or mediating pathways for mortality in future research.

General trends

As illustrated in Figure S4.1, trends in self-harm and assault rates suggest a complex and dynamic relationship with overall prison population levels. While both adverse outcomes have been influenced by external factors-such as changes in regime and lockdown measures during the COVID-19 pandemic-their fluctuations over time may also reflect the association with underlying factors, including overcrowding, staffing shortages, and access to healthcare.

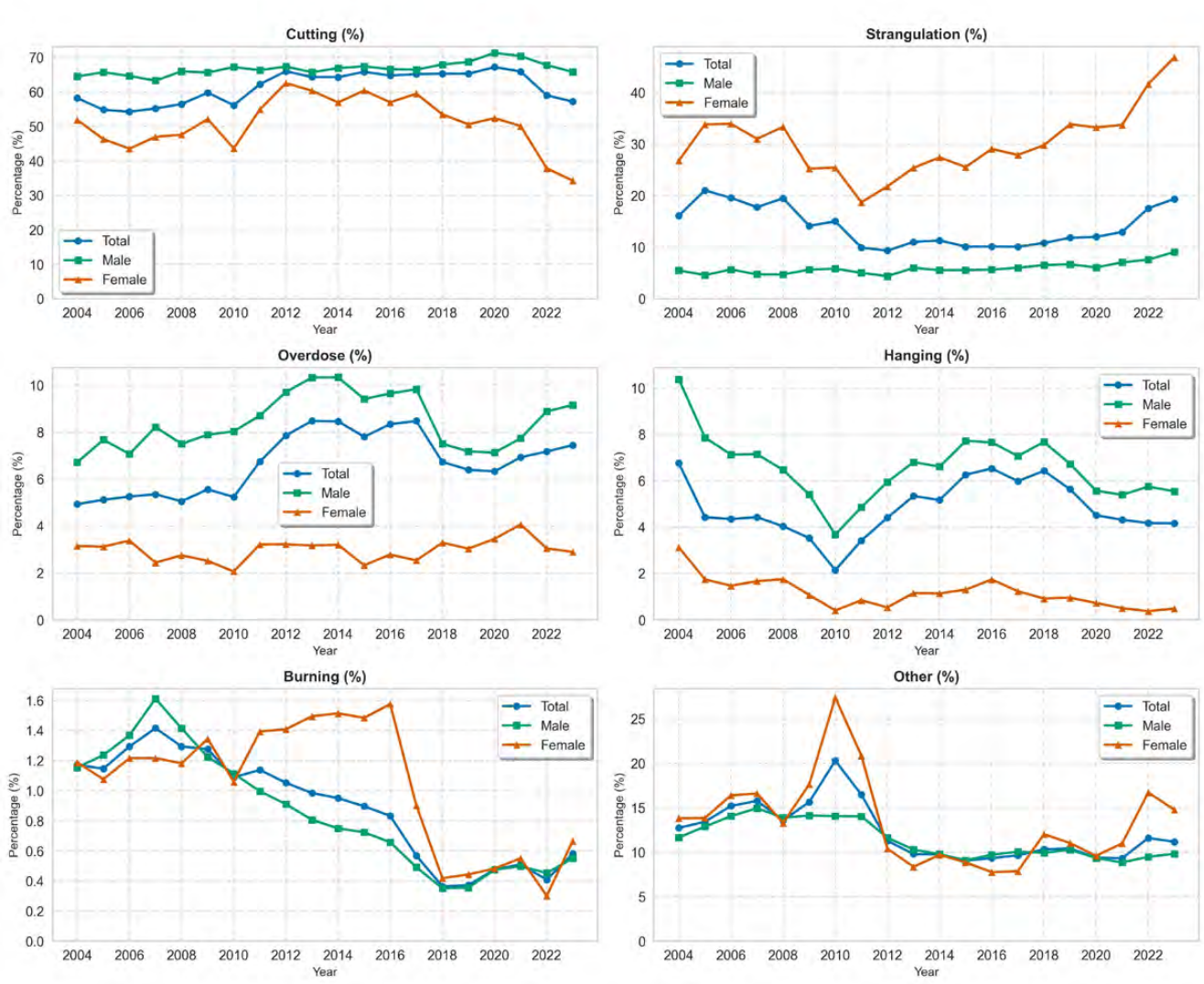
Figure S4.1. General trends in assault rates, self-harm rates, and prison population in England and Wales in 2013-2029



Self-harm methods

Self-harm patterns in custody reveal notable gender differences that have shifted over time (Fig. S4.2). Cutting remains the most common method across the estate, comprising around 60% of incidents, particularly among male prisoners. However, the data reveals a significant shift in methods among female prisoners, with strangulation incidents increasing dramatically from 27% in 2004 to nearly 70% by 2023. Simultaneously, cutting incidents among women have declined from over 50% to approximately 35%. Overdose, hanging, and burning are less common but also show gender-specific patterns-for example, overdose is more frequently observed among men. These shifts may reflect changes in access to implements, changes in surveillance practices, or evolving psychological stressors. Overall, high levels of self-harm are likely to reflect unmet mental health needs and may serve as early warning signs for more severe outcomes, including suicide.

Figure S4.2. Self-harm trends by gender in prisons in England and Wales (2004-2023).

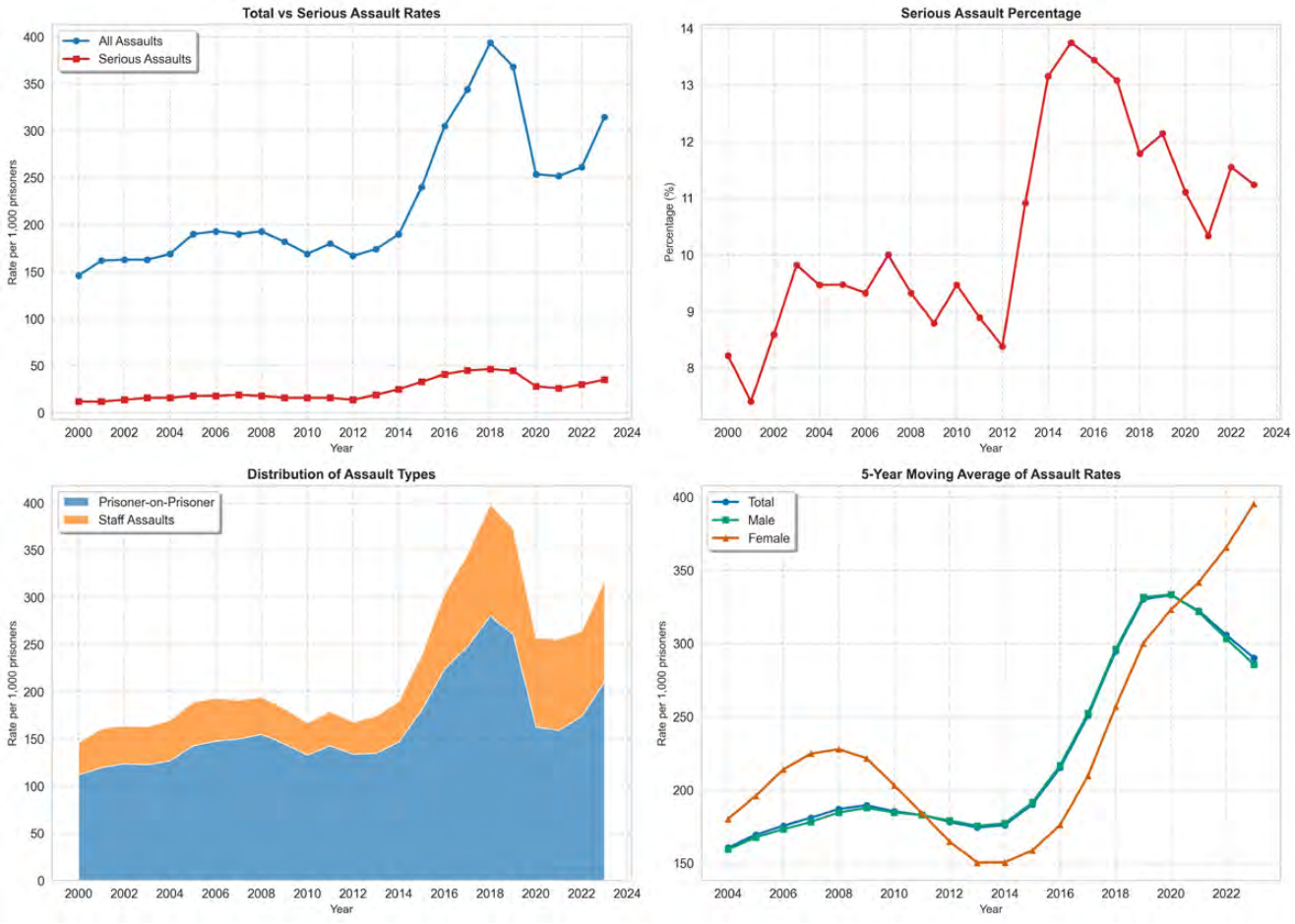


Note. Based on the Ministry of Justice Safety in Custody statistics (2023).

Assaults

Assaults in custody have also increased significantly in recent years (Fig. S4.3). From 2013 to 2018, total assault rates were rising, peaking at nearly 400 incidents per 1,000 prisoners before falling during the COVID-19 period. Since 2021, however, assault rates have rebounded, reaching 314 per 1,000 by 2023. Serious assaults-those involving injury or the use of weapons-have also increased, rising from around 15 per 1,000 prisoners in 2000 to 48 per 1,000 in 2018. The proportion of serious assaults grew substantially between 2013 and 2016. Gender trends are similarly important: while female establishments initially reported higher assault rates prior to 2010, rates among women have risen more steeply since 2016 and now surpass those in male prisons. Most assaults involve prisoner-on-prisoner violence, but incidents against staff remain substantial, especially during periods of high institutional stress (e.g. 2017–2019). These patterns may be linked to deteriorating prison order, inadequate staffing, or the psychosocial impact of confinement-all of which can elevate the risk of preventable deaths through overdoses, suicides, or deaths from undetermined causes.

Figure S4.3. Prison assault trends by gender in prisons in Egland and Wales (2000-2023)



Conclusion

Taken together, the observed trends in self-harm and assault suggest that these adverse events may serve as important indicators-and potentially mediating pathways-linking overcrowding and institutional stress to mortality in custody. Their persistence and recent resurgence highlight the need for improved mental health provision, violence prevention strategies, and better monitoring systems within prisons. Future research using establishment-level data is essential to clarify these relationships and inform targeted interventions aimed at reducing preventable deaths.

Independent
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